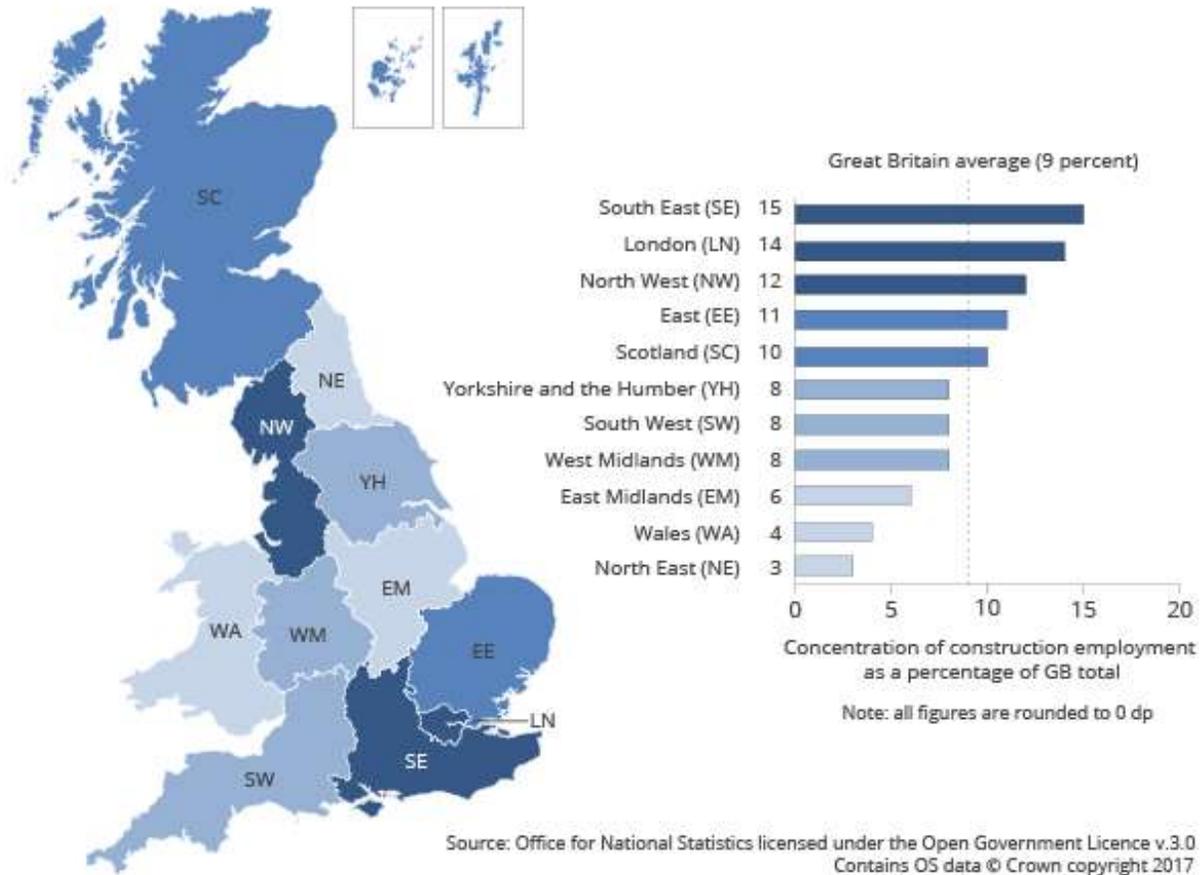




Low Emission Construction for London
“Best in Class” Emission Reduction

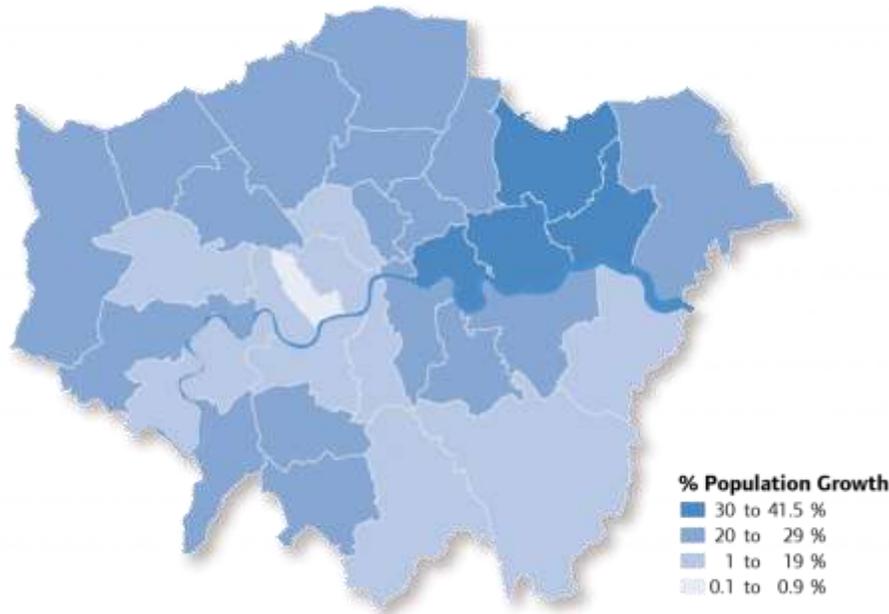
Daniel Marsh
12th March 2019

Construction Industry



- Construction is the third largest economic sector in the UK
- GB construction output 2018 growth of 2.1% to £159.6 bn.
- Despite Brexit uncertainties, 2018 was still forecast to be the highest level of construction output on record
- Future growth reliant on infrastructure projects - HS2 and the Northern Powerhouse

Growing urban populations



© GLA 2013 Round Population Projections
© Crown Copyright and database right 2013. Ordnance Survey 100032216 GLA.

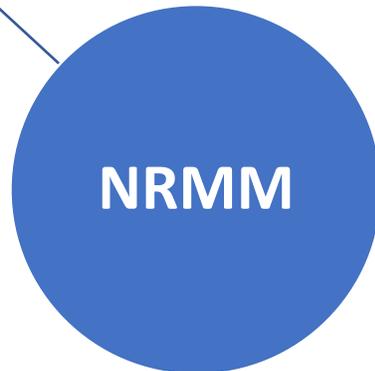
- GLA central predictions: 9.2 million in 2021 rising to >10 million in 2036
- Across UK many cities have grow by 50%.
- Internationally, urban population in 2014 was 54% of the total global population (WHO).
- Emissions from the construction industry will continue to increase in importance and therefore require quantification and regulation by urban and national governments.



- Raising awareness of industry impacts on local air quality
- Encourage uptake of 'cleaner' mitigation measures
- Present case studies with cost benefit for low emission solutions



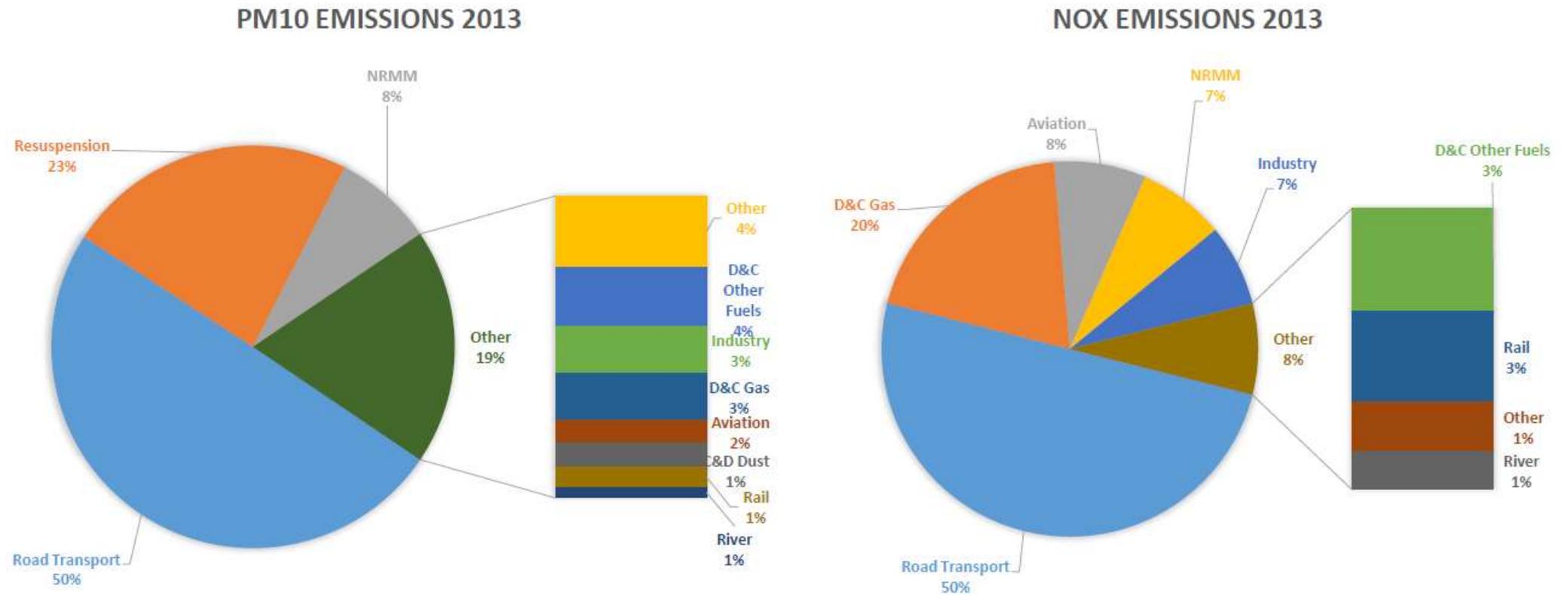
- Measure 'real world' emissions
- Emission reduction trials
- Improve pollution monitoring and quality of data



- LEZ enforcement
- Policy support
- NRMM database

Phase 1: 2014-16
Phase 2: 2016-19

Why target construction?



Source: GLA LAEI 2013

Occupational exposure

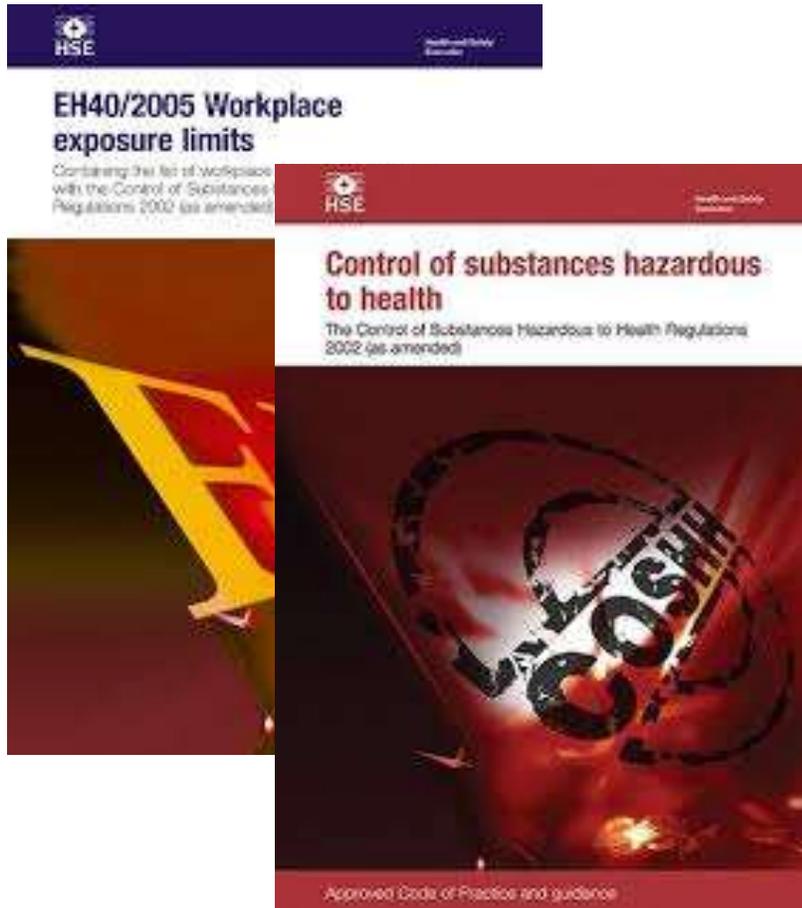


HSE: New workplace exposure limits for diesel exhaust proposed

Annually, between, 2016-17, around 3,000 workers were suffering with breathing and lung problems they believed were caused or made worse by their work, equivalent to 0.14% of workers. This rate is significantly higher than the 0.08% for workers across all industries.

Source: Work-related injuries and ill health statistics for the construction industry CITB 2016-17

Occupational exposure



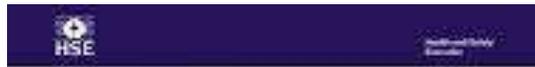
HSE: New workplace exposure limits for diesel exhaust proposed 2017

HSE: COSHH regulations

Every employer shall ensure that the exposure of his employees to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled.

Diesel emissions are known carcinogens

Occupational exposure



EH40/2005 Workplace exposure limits

Combining the list of Workplace with the Control of Substances Regulations 2002 (as amended)



Control of substances hazardous to health

The Control of Substances Hazardous to Health Regulations 2002 (as amended)



HSE: New workplace exposure limits for diesel exhaust proposed 2017

HSE: COSHH regulations

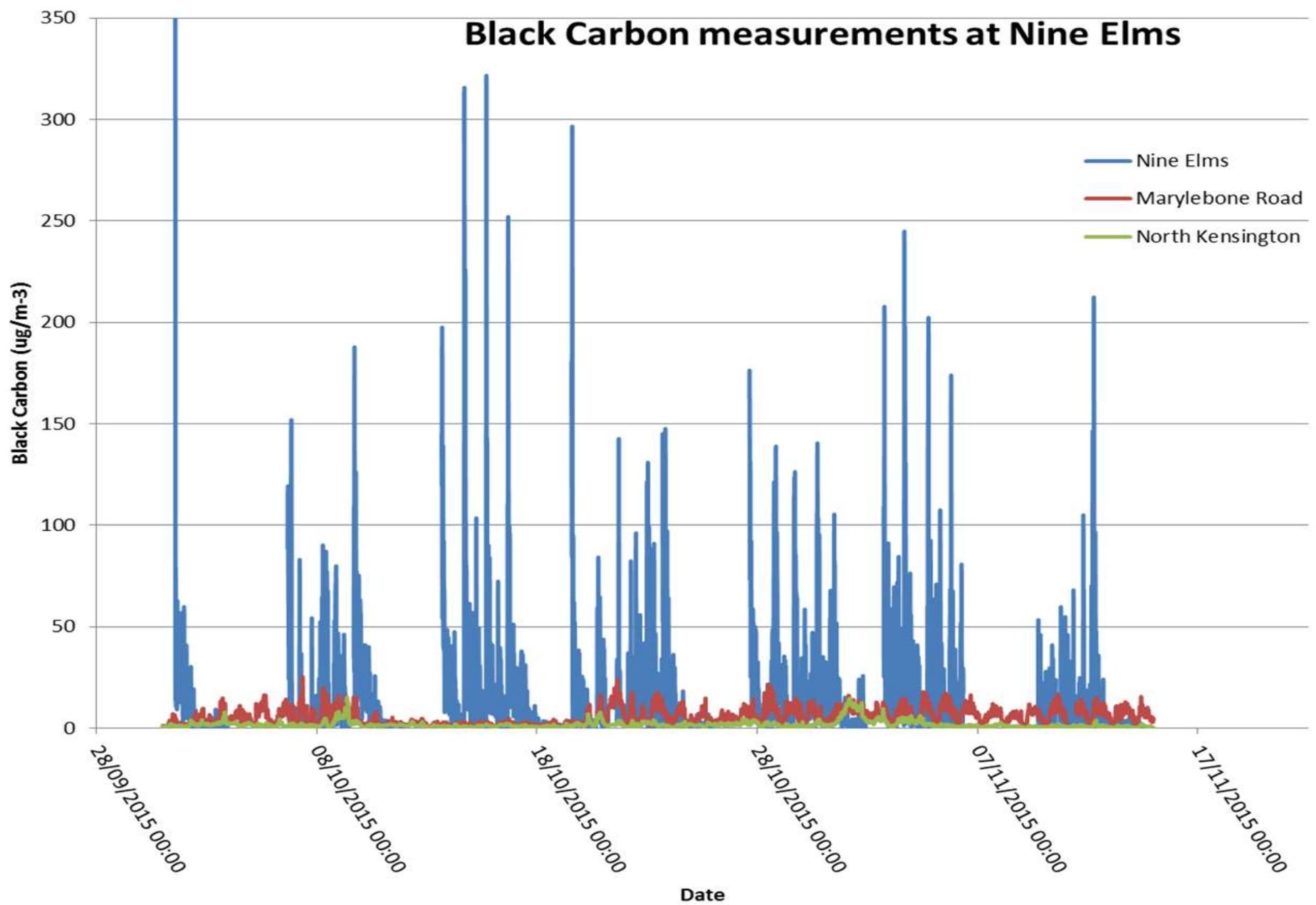
Every employer shall ensure that the exposure of his employees to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled.

Exhaust emissions are known carcinogens

IOSH: NTTL Campaign

Raising awareness of the health risks associated to diesel exposure within the construction industry

Black Carbon measurements at Nine Elms



Filter removed from Osiris dust monitor
after 8 weeks sampling next to the offices at
Nine Elms Northern Line Extension



Blank



Exposed for 8 weeks

Current guidance for construction

- GLA SPG
The Control of Dust and Emissions during Construction and Demolition (2014)
- IAQM
Guidance on Monitoring in the Vicinity of Demolition and Construction Sites (2018)
- Guidance on the assessment of dust from demolition and construction (2014)
- Boroughs own construction guidance



What is '*Best in Class*' emission reduction?

- Existing documentation sets minimum standards required at all developments
- *New 'Best in class'* encourages uptake of low emission approaches that will further reduce the impacts on worker exposure, local air quality and the environment
- It will be made available online at:

<http://www.llecp.org.uk/resources/guidance>

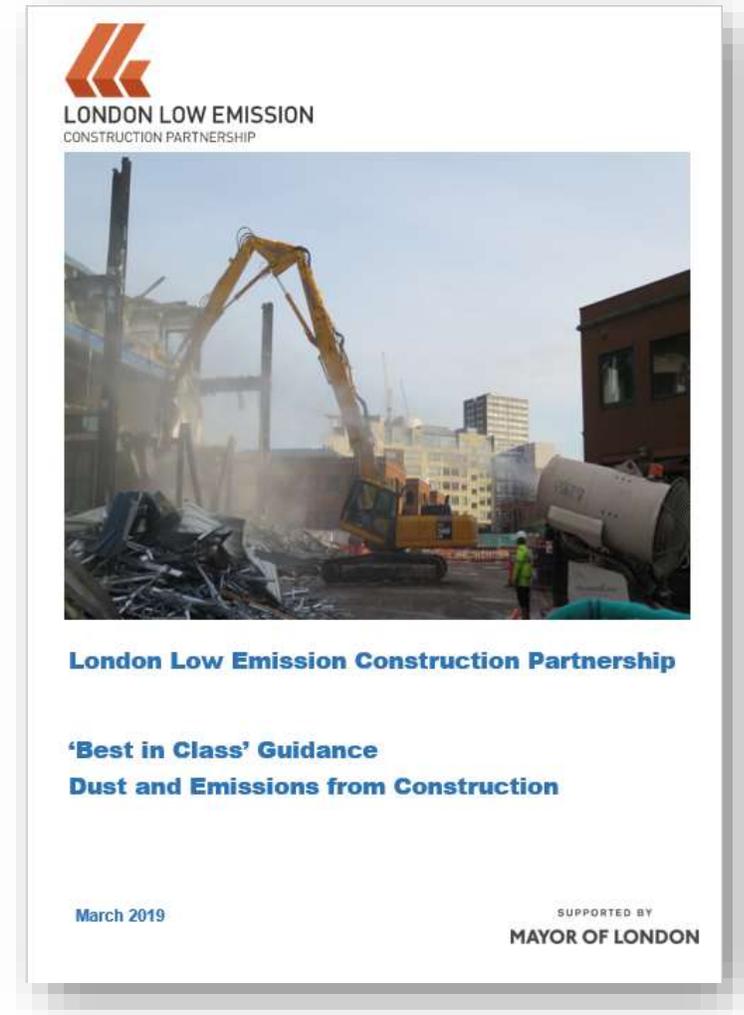


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Fugitive Dust

Only contributes 1% of total PM₁₀ emitted in London

Visual problem and the cause of most air quality related complaints in construction

Carried out as a planning requirement but often done to a very poor standard

Potentially leads to false alerts or missed pollution incidents



Purpose of dust monitoring

- ensure that construction activities do not cause any exceedances of the air quality objectives for PM_{10} .
- ensure that the site mitigation measures outlined in the dust management plan are being applied and are effective;
- provide a rapid “alert” system to notify key personnel on site of any exceedance of the agreed threshold concentrations in order that appropriate action may be taken;
- provide a body of evidence on the likely contribution of the site works for reporting back to the local planning authority, other stakeholders and at public meetings



Improving data quality

Site Action Levels

- Historical Site Action Level
 - 250 $\mu\text{g}/\text{m}^3$, measured as a 15-minute mean PM_{10} concentration (Fuller & Green 2004)
 - Limited data set
 - Adopted by IAQM/GLA
- Revised Site Action Level
 - **190 $\mu\text{g}/\text{m}^3$, measured as a 1-hour mean**
 - Using reference-equivalent samplers
 - Analysis included 9 construction sites and 1.8 million data points
 - **False alarms should be limited to around 0.1 % of time**
 - Standard adopted by IAQM



Re-assessment of the 250 $\mu\text{g m}^{-3}$
action limit

Work Package 2

Assessing the performance of light
scattering instruments

KING'S
College
LONDON

August 2018
David Green and Gary Fuller
Environmental Research Group
King's College London



Re-assessment of the 250 $\mu\text{g m}^{-3}$
action value

Work Package 1

Testing PM_{10} trigger values at
construction sites

KING'S
College
LONDON

August 2018
Anna Hunt and Gary Fuller
Environmental Research Group
King's College London

Re-assessment of the 250 $\mu\text{g m}^{-3}$
action value

Work Package 3

Implications for construction site
monitoring strategies

What to do when exceedance alerts are received?

A pollution incident report should contain the following information:

- Date/time of exceedance, number of exceedances
- Concentrations recorded as 15 minute or hourly means
- Monitoring locations
- Time of investigation following alert
- Meteorological conditions at the time of the exceedance
- Construction activity in vicinity of monitor
- Any other observations
- Action taken or control measures to mitigate and prevent recurrence



Improving data quality

- Good quality siting with a free movement of air around the inlet and clear lines of sight to expected sources
- Regular servicing, either on-site or back to base for cleaning and recalibration
- Regular visits to change filters and adjust flows as necessary and to assess site environs to ensure that the monitor and location remain fit for purpose
- Traceability - adequate records kept
- Heated inlet to reduce water vapour
- Regular data download and checking to ensure that equipment remains operational, to assess for consistency over time and make between instrument comparisons to identify outlier performance.



The London Environment Strategy

The NRMM Low Emission Zone will include progressively tightening standards, with the current proposals as follows:

- **2015: Stage IIIB in the Central Activities Zone (CAZ) plus Canary Wharf area, Stage IIIA everywhere else**
- **2020: Stage IV in CAZ plus Opportunity Areas, Stage IIIB everywhere else.**
- **2025: Stage IV throughout London**
- **2030: Stage V throughout London**
- **2040: Zero emissions throughout London**

The Mayor will continue to review the NRMM Low Emission Zone standards to ensure that they deliver the largest possible improvements.

Policy 4.2.3 Reduce emissions from non-transport sources, including by phasing out fossil fuels

Proposal 4.2.3a The Mayor will work with government, TfL, the London boroughs, the construction industry and other users of Non-Road Mobile Machinery (NRMM), such as event organisers, to prevent or reduce NRMM emissions

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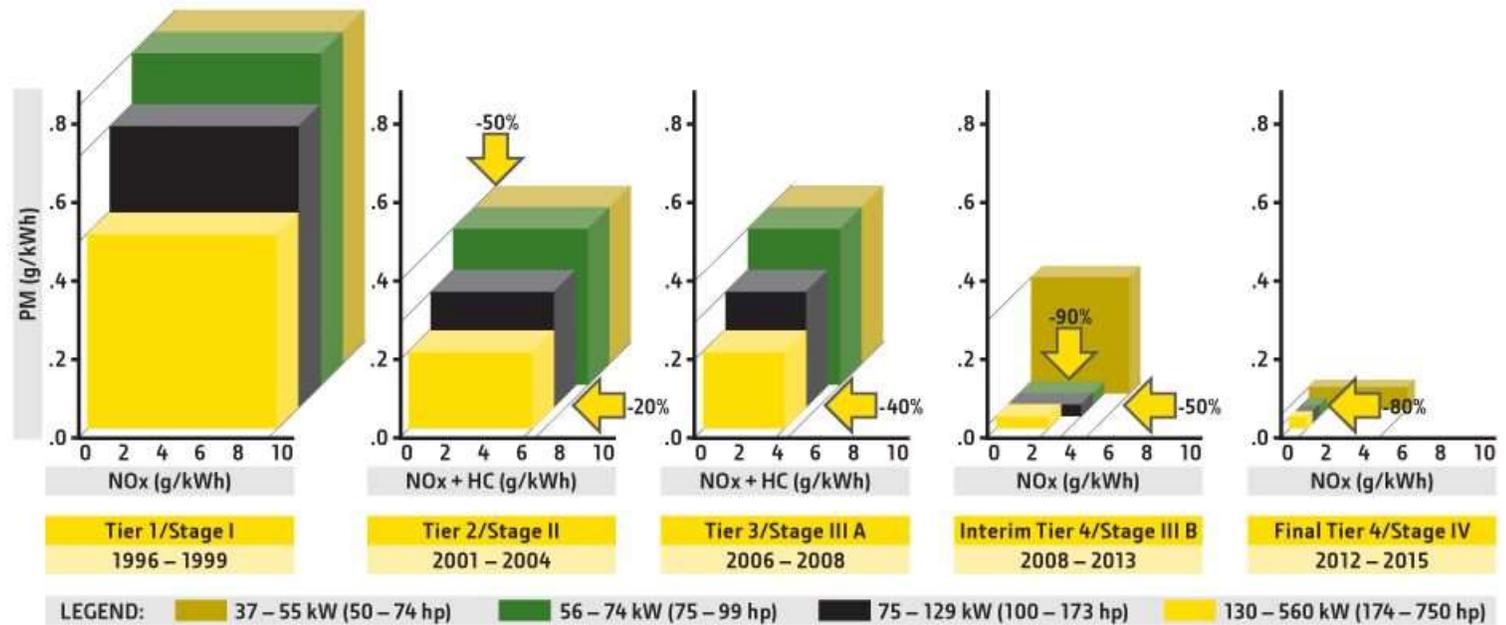


What is non-road mobile machinery?

Stage V emission standards for NRMM

- Engine standards have been agreed and production started in 2019
- Standards apply to diesel engines from 0-56 kW and all engines above 56 kW
- Engine limit value for particle number as well as particle mass emissions
- Defeat strategies are prohibited

EPA and EU nonroad emissions regulations: 37 – 560 kW (50 – 750 hp)





Retrofit

Retrofitting of older equipment with after-exhaust pollution control systems will significantly reduce emissions

More cost-effective than fleet renewal

Diesel particulate filters can be fitted to almost any piece of machinery that uses a diesel engine

SCR systems becoming more widely available for NRMM

Potential to meet higher emission standard requirement for use within the LEZ central activity zone

NRMM regulation is important!

- London is leading by example but NRMM requirements are coming to other UK cities
- DEFRA Clean Air Strategy 2018
- DEFRA – call for evidence on use of red diesel in NRMM
- Improved NRMM atmospheric emission inventories for future policy development
- Scientific evidence from epidemiology is increasing

5.8 Non-Road Mobile Machinery

Non-road mobile machinery (NRMM) covers a wide range of machinery which moves or is intended to move (whether self-propelled or not) and contains a combustion engine. It includes agricultural machinery, construction equipment, non-sea faring boats, watercraft and a range of industrial equipment such as off road trucks, road resurfacing machines and mobile crushers, as well as transport refrigeration units (TRUs) and smaller household machinery such as lawn mowers and generators.

The sector is responsible for emissions of NO_x, PM, SO₂ and VOCs. Emissions of SO₂ are controlled by setting the maximum sulphur content of the fuel, with the remaining key pollutants being subject to regulations setting the maximum emissions levels - which are enforced at the point where the engine (or the product into which the engine is installed) is placed on the market in the UK. We are currently implementing more stringent emission standards which will be consistently applied across the wide range of engines used in NRMM from 2019 and drive reductions in emissions with the turnover of the fleet. We recognise that emission standards will be delivered significant reductions in emissions from NRMM and envisage they will be reviewed periodically to ensure they remain technically achievable.

NRMM

... which has a ... road diesel and ... in the UK, ... rates to air ... M makes ... rate ... the

In May 2018, HM Treasury and Defra jointly published a call for evidence into red diesel use, on whether red diesel for NRMM discourages the purchase of cleaner alternatives. Red diesel for agricultural use was out of scope, as were use in fishing vessels, home heating and other static units. In several sectors (for example transport refrigeration, construction machinery, airport ground equipment) lower emission machinery is becoming available, but we are aware that it may not suit all applications, and that other sectors do not yet have viable alternatives to machinery with diesel engines. We are developing options for encouraging a transition to cleaner technologies and will announce next steps in Spring 2019.

5.8.1 Taking further action to tackle emissions from NRMM

Having considered the state of art, stakeholder responses and options available to reduce emissions from NRMM, we have decided to:

- In the first instance, explore the use of environmental permitting for significant NRMM sources where appropriate, to ensure consistent approaches are applied across England to regulate emissions
- Introduce new legislation to enable the Transport Secretary to compel manufacturers to recall NRMM for any failures in their emissions control system, to ensure the more stringent standards deliver a reduction in emissions in the real world
- Where certain types of NRMM pose a risk to air quality only in specific locations, we will work with industry and local bodies to identify local solutions
- Keep under review the need to make tampering with an NRMM emissions control system a legal offence, recognising that such

Alternatives to diesel?

Includes Biodiesel (B20-B100), Hydrotreated vegetable oil (HVO), Gas-to-Liquid (GTL) and ISO-grade fuels

Current lack of scientific evidence for emission reduction benefits

Not as effective as stage V or proven retrofit technology

Difficult for in-field testing for compliance purposes

Further research required to assess efficacy in real-world environment



Alternatives to diesel?



Hybrid



Solar

Hydrogen



Full Electric



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Construction Logistics Plans (CLP's)

A CLP is an important management tool for planners, developers and construction contractors

The CLP focuses specifically on construction supply chains and how their impact on the road network can be reduced

The construction supply chain covers all movements of goods, waste and servicing activity to and from site



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Borough Funding for Construction and NRMM

LLECP Partner boroughs provided information on the approaches they use for funding compliance work associated with NRMM. These included:

- Employing S106/CIL funding agreements
- Funding through existing team budgets
- Self-funded code of construction practise

Also includes information on:

- NRMM audit models
- Enforcement of non-compliance
- Fee structures



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